

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project**
**Economic Analysis: Water Supply
Costs and Benefits**

Introduction

This attachment provides an overview of the water supply costs and benefits for the Santa Anita Stormwater Flood Management and Seismic Strengthening Project. This Project will result in a benefit of reliable increased local water supply of 518 AFY compared to the without Project condition. To quantify this benefit, we have analyzed the costs to purchase and deliver an equivalent supply of imported water. The associated Project benefit information is summarized in Table 8.1. The magnitude of benefits, monetized when possible, is shown in Table 8.7. Detailed cost and benefit information associated with the Project, including present value calculations, are presented in the attached tables in Appendix 8-A.

Table 8.1: Benefits Summary

Type of Benefit	Assessment Level	Beneficiaries
Avoided water imports due to increased water conservation	Quantitative	Local / Regional / Statewide
Avoided cost for improvement of Infrastructure	Quantitative	Local
Improved water supply reliability	Qualitative	Local and Regional

Avoided Water Supply Purchases

This Project is expected to create local water supply due to increased storage behind Santa Anita Dam (Dam) and Santa Anita Debris Basin (Debris Basin), increased spreading ground capacity at Santa Anita Spreading Grounds (Spreading Grounds), and Headworks improvements that will enable the District to reliably divert stormwater runoff to the Spreading Grounds to maximize conservation efforts and generate water savings through avoided purchase of imported water supply.

The costs savings arising from the Project's increased water supply is the cost that would otherwise be required to purchase an equivalent water supply. The least cost replacement water supply would be imported water purchased from MWD. The costs are estimated based on the projected future cost of imported water. This requires a projection of the cost of providing equivalent imported water for the water supply to the East Raymond Basin.

This attachment discusses how the forecasting of the future avoided cost of import water was addressed to develop the avoided water supply costs that are used to evaluate the benefits of this Project that conserves water for the Cities of Sierra Madre and Arcadia.

Table 8.2 compares the Tier 1 water rate projection published by MWD for 2005 – 2009 with actual water rates to illustrate differences in forecasted and actual water rates. As Table 8.2 shows, the margin of error associated with the forecast increases with time. This analysis

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required MWD water rates be forecast through 2060 to match the length of time over which benefits of reduced demand for imported water accrue.

Table 8.2: Comparison of Projected and Actual MWD Tier 1 Water Rates

Year	Projected		Actual		Difference (a)	
	Untreated	Treated	Untreated	Treated	Untreated	Treated
2005	\$331	\$443	\$331	\$443	0.0%	0.0%
2006	\$335	\$460	\$331	\$453	-1.2%	-1.5%
2007	\$345	\$476	\$331	\$478	-3.9%	40.0%
2008	\$361	\$497	\$351	\$508	-2.6%	2.3%
2009	\$379	\$523	\$436	\$620	15.0%	18.7%
Notes: All dollar values are nominal. Projected Tier 1 MWD water rates are sources from the 2004/05 Long Range Finance Plan, whereas actual MWD Tier 1 water rates are sources from the MWD "Water Rates and Charges". Projected MWD Tier 1 water rates are computed as the midpoint of the low and high projected rates.						

Appendix 8-B shows the projected real MWD full service Tier 1 and untreated replenishment water rates used to measure the avoided cost of imported water purchase in this analysis for the Project life. For illustration purposes, Table 8.3 provides an abbreviated version of the projected rates (thru 2019). Annual year-over-year percentage changes to the real water rates are also shown in the final two columns of Table 8.2

Table 8.3: Projected MWD Real Treated and Untreated Water Rates 2009-2019

Year	Projected Real MWD Water Rates (\$/AF)*		% change in Projected Real MWD Water Rates	
	Tier 1		Tier 1	
	Treated	Untreated	Treated	Untreated
2009	620	436		
2010	690	476	11.29%	9.17%
2011	726	513	5.22%	7.77%
2012	760	537	4.68%	4.68%
2013	793	560	4.34%	4.28%
2014	826	583	4.16%	4.11%
2015	856	604	3.63%	3.60%
2016	887	626	3.62%	3.64%
2017	919	649	3.61%	3.67%
2018	952	672	3.59%	3.54%
2019	987	697	3.68%	3.72%

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In addition to the avoided imported water costs from MWD, we must also include the costs to construct infrastructure to deliver this replacement water for the communities served by the East Raymond Basin. The Raymond Basin Management Plan has a Water Supply Reliability Program that has outlined an extension of the existing San Gabriel Valley MWD Devil Canyon Azusa Feeder Pipeline from its present terminus in Azusa to the Raymond Basin. This new feeder pipeline would permit delivery of untreated water to the existing Santa Anita and Sierra Madre Spreading Grounds for recharge into the East Raymond Groundwater Basin.

To accomplish this recharge, the feeder pipeline would have to be connected to the Headworks and the Debris Basin. These connections would allow for variations in volume and duration/rate of flow from MWD, which would not be possible if discharged directly to the spreading grounds. Raymond Basin Management estimated \$24,379,810 for infrastructure upgrades are needed to construct this feeder extension.

Although the Water Supply Reliability Program was developed, there is currently no schedule or plan to construct the Raymond Basin Feeder Pipeline at this time. This economic analysis recognizes the feeder pipeline as the most feasible and least cost alternative to bring replacement water to the communities served by the East Raymond Basin; therefore, its total cost was included in this analysis. In the event the feeder pipeline is actually constructed during the life of the Project, it would deliver significantly more water to the Project facilities, excluding the Dam for recharge to the East Raymond Basin. That additional groundwater recharge capability would not be possible without the Project. These potential additional benefits are not included in the economic analysis.

Distribution of Project Benefits and Identification of Beneficiaries

The following table summarizes the Project's beneficiaries. The Project will benefit local residents by reducing the potential damage, increasing seismic safety, and increasing sustainability of local water supply, thus improving the quality of life.

Table 8.4: Project Beneficiaries Summary

Local	Regional	Statewide
Local Residents	Greater Los Angeles Region	NA

Project Benefits Timeline Description

The Project benefits would be realized beginning in 2014. This Project will provide water supply benefits in excess of the 50-year Project lifetime (2009-2060).

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Uncertainty of Benefits

Projected savings associated with using local surface water for recharge as opposed to imported water represent best estimates based on the latest available data. Actual water savings will vary. This calculation of benefits assume available alternate water supply through creation of infrastructure and availability of MWD water. In the event this alternate water supply could not be relied upon through 2060, the actual project benefits would be significantly increased since additional alternative sources of replacement water would be required. This analysis is a conservative, lower bound estimate of projects benefits and does not account for additional cost avoidance that would be associated with lack of availability of MWD water. Another conservative assumption is that MWD would charge Tier 1 rates for the imported water, whereas the Feeder Pipeline could be considered a new source of water which would result in higher tier 2 rates.

Table 8.5: Omissions, Biases, and Uncertainties and their Effect on the Project

Benefit or cost category	Likely impact on net benefits*	Comment
Avoided Imported Water Cost		
• Water rate forecast (MWD)	+/-	Margin of error implicit in forecasting
• Climate	+	The Projections also are driven by “normal year” expectations, whereas dry year conditions will add additional cost pressures and may move some of the imported water to higher cost Tier 2 levels.
• Regulatory/legal	+	Recent regulatory/ legal issues Combine to make it more likely than not that the future availability of MWD-provided imported waters will be increasingly constrained and that costs will escalate at rates higher than experienced in the recent past and forecast in this analysis.
• Increased water demands	+	Other MWD users may increase their demand, which may result in higher rates (holding supply constant).
Water Supply Reliability	+	The monetized value of added local supply reliability is not included in the benefit-cost comparison. If we had added the present value benefit of improved water reliability into the overall benefit-cost analysis, net benefits would increase.

* Direction and magnitude of effects on net benefits

- + Likely to increase net benefits relative to quantified estimates
- ++ Likely to increase net benefits significantly
- Likely to decrease net benefits
- Likely to decrease net benefits significantly
- +/- Uncertain

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Description of any adverse effects

Any potential adverse effects from this Project would occur during construction and will be mitigated in accordance with mitigation measures identified in the environmental documents and permits.

The “Without Project” Baseline

The Cities of Arcadia and Sierra Madre are required to provide water for their residents.

Appendix 8-C, includes the District’s analysis using actual hydrologic data from the Dam. It and models the amount of water that would be conserved with the No Project alternative and the associated State mandated restriction on the Dam and Debris Basin. This model has the lowest valve at both the Dam and Debris Basin open 100% of the time, as mandated by the State without seismic upgrades, and washes out the Headworks at 300 cfs. In addition, as existing conditions dictate, the Headworks diversion capabilities are limited to up to 75 cfs. These are the baseline conditions that would be expected.

The model shows that for a 14-year time span from 1996 – 2010; the timeline for which the District has digital hydrologic data, the District would be able to conserve 43,415 acre-feet, which averages about 3,101 acre-feet per year (AFY). Utilizing data from 1996 – 2010, offers a range of wet, dry, and average water years that is truly representative of actual fluctuations .

The model was used to run that same time span and data with the proposed Project. The model shows that approximately 50,669 acre-feet of water would be conserved in that same timeframe. That averages 3,619 AFY.

Without the Project, 518 AFY of local water supply would not be available. This lost supply would need to be supplemented by the purchase of imported water.

If this Project were not implemented, approximately \$24,379,810 in infrastructure costs (in 2009 Dollars) would be required to extend a MWD feeder pipeline to deliver imported water from MWD into the spreading grounds. In addition to the infrastructure costs, those cities would incur yearly imported water costs to make up the difference needed for their residents. The water costs would be from Tier 1 Untreated Water.

Project Costs

The total estimated cost for the Project is \$40,000,000. The operations and maintenance costs through 2060 will be reduced since the District would not have to periodically rebuild the Headwork. However, these costs are offset by increased maintenance costs associated with

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additional mechanical gates, operators and control systems. In present value 2009 dollars, the cost of the Project is \$33,350,000. Capital costs are expended from 2010 – 2013.

Table 8.6: Project Budget

	(a)	(b)	(c)	(d)	(e)
Budget Category	Non-State Share* (Funding Match)	Requested Grant Funding	Other State Funds Being Used	Total	% Funding Match
(a) Direct Project Administration Costs	147,320	0	0	147,320	100
(b) Land Purchase/Easement	0	0	0	0	0
(c) Planning/Design/Engineering/Environmental Documentation	1,763,586	1,000,000	0	1,763,586	43
(d) Construction/Implementation	14,500,000	19,000,000	0	33,500,000	43
(e) Environmental Compliance/Mitigation/Enhancement	0	0	0	0	0
(f) Construction Administration	1,239,094	0	0	1,239,094	100
(g) Other Costs (Including Legal Costs, Permitting and Licenses)	0	0	0	0	0
(h) Construction/Implementation Contingency	3,350,000	0	0	3,350,000	100
(i) Grand Total (Sum rows (a) through (h) for each column)	20,000,000	20,000,000	0	40,000,000	50
*Sources of funding: District Budget					

Project Benefit Costs Comparison

The total present value of the costs for the Project, along with monetized and qualitative benefits, is provided in Table 8.7.

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Table 8.7: Benefit-Cost Analysis Overview

	<u>Present Value</u> (In 2009 Dollars)
Costs – Total Capital and O&M	\$33,350,000
Monetizable Benefits	
Water Supply Benefits (Avoided water supply purchases – 518AFY)	\$4,883,554
Water Supply Benefits (Avoided Project cost)	\$18,284,858
Flood Damage Reduction	\$117,992,441
Total Benefits	\$141,160,852
Qualitative Benefits	<u>Qualitative Indicator**</u>
Water Supply Benefits (Improved supply reliability)	+
Reduced Impacts to other infrastructure	+
Reduced Impacts to Quality of Life and Commerce	+
Water Supply Benefits (Enhanced Bay-Delta Ecosystem habitat)	+/-

** Magnitude of effect on net benefits
 +/- (negligible or unknown)
 + (moderate)
 ++ (significant)

Methods used to Estimate With- and Without-Project Conditions

The annual cost of implementation of the Project is provided in Table 8.A.1 of Appendix 8-A. The life of the Project is estimated to be 50 years. The values used for this analysis were derived from a hydrology model using actual runoff data from 1994 – 2010 (see Appendix 8-C for the model and its assumptions).

The annual water supply benefits of implementing the Project are provided in Table 8.A.2 of Appendix 8-A. For this analysis, MWD Tier 1 untreated water was used for the value of water that the Cities of Sierra Madre and Arcadia would have to purchase.

The annual costs of avoided projects are provided in Table 8.A.3 of Appendix 8-A. The avoided project costs were developed by the East Raymond Basin Management Board. The avoided costs include the costs to modify the existing system to distribute untreated water to the spreading grounds to supplement native water that would not be available without the Project.

The total water supply benefits for the Project shown in Table 8.7 above are provided in Table 8.A.5 of Appendix 8-A. These benefits are provided through avoided imported water purchases and avoided project costs and have a present value (2009) of \$ 23,168,411.

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APPENDIX 8-A

Tables

Table 8.A.1 - Annual Cost of Project (all costs should be in 2009 dollars)									
Project: Santa Anita Stormwater Flood Management and Seismic Strengthening Project									
Year	Initial Cost		Operations and Maintenance Costs				Discounting Calculations		
	(a) Grant Total Cost (row (i), column (d))	(b) Admin	(c) Operation	(d) Maintenance	(e) Replacement	(f) Other	(g) Total	(h) Discount Factor	(i) Discounted Costs (g) x (h)
2009	\$0	\$0	\$0	\$0	\$0	\$0	\$0	1	\$0
2010	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.943	\$0
2011	\$2,500,000	\$0	\$0	\$0	\$0	\$0	\$2,500,000	0.89	\$2,225,000
2012	\$30,000,000	\$0	\$0	\$0	\$0	\$0	\$30,000,000	0.84	\$25,200,000
2013	\$7,500,000	\$0	\$0	\$0	\$0	\$0	\$7,500,000	0.79	\$5,925,000
2014	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.75	\$0
2015	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.71	\$0
2016	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.67	\$0
2017	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.63	\$0
2018	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.59	\$0
2019	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.56	\$0
2020	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.53	\$0
2021	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.5	\$0
2022	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.47	\$0
2023	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.44	\$0
2024	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.42	\$0
2025	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.39	\$0
2026	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.37	\$0
2027	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.35	\$0
2028	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.33	\$0
2029	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.31	\$0
2030	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.29	\$0
2031	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.28	\$0
2032	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.26	\$0
2033	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.25	\$0
2034	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.23	\$0
2035	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.22	\$0
2036	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.21	\$0
2037	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.2	\$0
2038	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.19	\$0
2039	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.17	\$0
2040	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.16	\$0
2041	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.16	\$0
2042	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.15	\$0
2043	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.14	\$0
2044	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.13	\$0
2045	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.12	\$0
2046	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.12	\$0
2047	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.11	\$0
2048	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.1	\$0
2049	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.09	\$0
2050	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.09	\$0
2051	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.08	\$0
2052	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.08	\$0
2053	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.07	\$0
2054	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.07	\$0
2055	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.07	\$0
2056	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.06	\$0
2057	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.06	\$0
2058	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.05	\$0
2059	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.05	\$0
2060	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.05	\$0
Project Life	Total Present Value of Discounted Costs (Sum of Column (i))						\$33,350,000		

Table 8.A.2 - Annual Water Supply Benefits (2009 dollars)							
Project: Santa Anita Stormwater Flood Management and Seismic Strengthening Project							
(b) Type of Benefit: Avoided water imports due to increased groundwater supply / storage						Discounting Calculations for Economic Benefits	
(c) Measure of Benefit (Unit): AF per Year						Benefits	
(a) Year	(d) without Project	(e) With Project	(f) Change Resulting from Project (e-d)	(g) Unit \$ Value	(h) Total Annual \$ Value (f x g)	(i) Discount Value	(j) Discounted Benefits (h x i)
2009	0	0	0	0	\$436	\$0	\$0
2010	0	0	0	0	\$476	\$0	\$0
2011	0	0	0	0	\$513	\$0	\$0
2012	0	0	0	0	\$537	\$0	\$0
2013	0	0	0	0	\$560	\$0	\$0
2014	-518	0	518	518	\$583	\$301,994	\$226,496
2015	-518	0	518	518	\$604	\$312,872	\$222,139
2016	-518	0	518	518	\$626	\$324,268	\$217,260
2017	-518	0	518	518	\$649	\$336,182	\$211,795
2018	-518	0	518	518	\$672	\$348,096	\$205,377
2019	-518	0	518	518	\$697	\$361,046	\$202,186
2020	-518	0	518	518	\$722	\$373,996	\$198,218
2021	-518	0	518	518	\$729	\$377,622	\$188,811
2022	-518	0	518	518	\$736	\$381,248	\$179,187
2023	-518	0	518	518	\$743	\$384,874	\$169,345
2024	-518	0	518	518	\$751	\$389,018	\$163,388
2025	-518	0	518	518	\$758	\$392,644	\$153,131
2026	-518	0	518	518	\$765	\$396,270	\$146,620
2027	-518	0	518	518	\$773	\$400,414	\$140,145
2028	-518	0	518	518	\$780	\$404,040	\$133,333
2029	-518	0	518	518	\$788	\$408,184	\$126,537
2030	-518	0	518	518	\$796	\$412,328	\$119,575
2031	-518	0	518	518	\$804	\$416,472	\$116,612
2032	-518	0	518	518	\$811	\$420,098	\$109,225
2033	-518	0	518	518	\$820	\$424,760	\$106,190
2034	-518	0	518	518	\$828	\$428,904	\$98,648
2035	-518	0	518	518	\$836	\$433,048	\$95,271
2036	-518	0	518	518	\$844	\$437,192	\$91,810
2037	-518	0	518	518	\$852	\$441,336	\$88,267
2038	-518	0	518	518	\$860	\$445,480	\$84,641
2039	-518	0	518	518	\$869	\$450,142	\$76,524
2040	-518	0	518	518	\$878	\$454,804	\$72,769
2041	-518	0	518	518	\$886	\$458,948	\$73,432
2042	-518	0	518	518	\$894	\$463,092	\$69,464
2043	-518	0	518	518	\$903	\$467,754	\$65,486
2044	-518	0	518	518	\$912	\$472,416	\$61,414
2045	-518	0	518	518	\$921	\$477,078	\$57,249
2046	-518	0	518	518	\$930	\$481,740	\$57,809
2047	-518	0	518	518	\$939	\$486,402	\$53,504
2048	-518	0	518	518	\$949	\$491,582	\$49,158
2049	-518	0	518	518	\$958	\$496,244	\$49,624
2050	-518	0	518	518	\$967	\$500,906	\$45,082
2051	-518	0	518	518	\$977	\$506,086	\$45,548
2052	-518	0	518	518	\$986	\$510,748	\$40,860
2053	-518	0	518	518	\$996	\$515,928	\$41,274
2054	-518	0	518	518	\$1,006	\$521,108	\$36,478
2055	-518	0	518	518	\$1,016	\$526,288	\$36,840
2056	-518	0	518	518	\$1,025	\$530,950	\$37,167
2057	-518	0	518	518	\$1,036	\$536,648	\$32,199
2058	-518	0	518	518	\$1,046	\$541,828	\$32,510
2059	-518	0	518	518	\$1,056	\$547,008	\$27,350
2060	-518	0	518	518	\$1,066	\$552,188	\$27,609
Total Present Value of Discounted Benefits over Project Life						Project Allocation: 100%	
Total Present Value of Discounted Benefits (Monetized Benefits):						\$4,883,554	

Table 8.A.3 - Annual Costs of Avoided Projects (2009 Dollars)							
Project: Santa Anita Stormwater Flood Management and Seismic Strengthening Project							
Alternative (Avoided Project Name): ERB Water Supply Upgrade		Discounting Calculations for Economic Benefit					
Avoided Project Description: ERB would need to upgrade it's current water distribution system to allow Tier 1 Treated Imported water to be delivered to its residents to meet water supply demand.							
(a) Year	(b) Avoided Capital Costs	(c) Avoided Replacement Costs	(d) Avoided O&M Costs	(e) Total Avoided Costs (b+c+d)	(f) Discount Value	(g) Discounted Benefit (exf)	
2009	\$0	\$0	\$0	\$0	1	\$0	\$0
2010	\$0	\$0	\$0	\$0	0.943	\$0	\$0
2011	\$0	\$0	\$0	\$0	0.89	\$0	\$0
2012	\$0	\$0	\$0	\$0	0.84	\$0	\$0
2013	\$0	\$0	\$0	\$0	0.79	\$0	\$0
2014	\$24,379,810	\$0	\$0	\$24,379,810	0.75	\$18,284,858	\$18,284,858
2015	\$0	\$0	\$0	\$0	0.71	\$0	\$0
2016	\$0	\$0	\$0	\$0	0.67	\$0	\$0
2017	\$0	\$0	\$0	\$0	0.63	\$0	\$0
2018	\$0	\$0	\$0	\$0	0.59	\$0	\$0
2019	\$0	\$0	\$0	\$0	0.56	\$0	\$0
2020	\$0	\$0	\$0	\$0	0.53	\$0	\$0
2021	\$0	\$0	\$0	\$0	0.5	\$0	\$0
2022	\$0	\$0	\$0	\$0	0.47	\$0	\$0
2023	\$0	\$0	\$0	\$0	0.44	\$0	\$0
2024	\$0	\$0	\$0	\$0	0.42	\$0	\$0
2025	\$0	\$0	\$0	\$0	0.39	\$0	\$0
2026	\$0	\$0	\$0	\$0	0.37	\$0	\$0
2027	\$0	\$0	\$0	\$0	0.35	\$0	\$0
2028	\$0	\$0	\$0	\$0	0.33	\$0	\$0
2029	\$0	\$0	\$0	\$0	0.31	\$0	\$0
2030	\$0	\$0	\$0	\$0	0.29	\$0	\$0
2031	\$0	\$0	\$0	\$0	0.28	\$0	\$0
2032	\$0	\$0	\$0	\$0	0.26	\$0	\$0
2033	\$0	\$0	\$0	\$0	0.25	\$0	\$0
2034	\$0	\$0	\$0	\$0	0.23	\$0	\$0
2035	\$0	\$0	\$0	\$0	0.22	\$0	\$0
2036	\$0	\$0	\$0	\$0	0.21	\$0	\$0
2037	\$0	\$0	\$0	\$0	0.2	\$0	\$0
2038	\$0	\$0	\$0	\$0	0.19	\$0	\$0
2039	\$0	\$0	\$0	\$0	0.17	\$0	\$0
2040	\$0	\$0	\$0	\$0	0.16	\$0	\$0
2041	\$0	\$0	\$0	\$0	0.16	\$0	\$0
2042	\$0	\$0	\$0	\$0	0.15	\$0	\$0
2043	\$0	\$0	\$0	\$0	0.14	\$0	\$0
2044	\$0	\$0	\$0	\$0	0.13	\$0	\$0
2045	\$0	\$0	\$0	\$0	0.12	\$0	\$0
2046	\$0	\$0	\$0	\$0	0.12	\$0	\$0
2047	\$0	\$0	\$0	\$0	0.11	\$0	\$0
2048	\$0	\$0	\$0	\$0	0.1	\$0	\$0
2049	\$0	\$0	\$0	\$0	0.1	\$0	\$0
2050	\$0	\$0	\$0	\$0	0.09	\$0	\$0
2051	\$0	\$0	\$0	\$0	0.09	\$0	\$0
2052	\$0	\$0	\$0	\$0	0.08	\$0	\$0
2053	\$0	\$0	\$0	\$0	0.08	\$0	\$0
2054	\$0	\$0	\$0	\$0	0.07	\$0	\$0
2055	\$0	\$0	\$0	\$0	0.07	\$0	\$0
2056	\$0	\$0	\$0	\$0	0.07	\$0	\$0
2057	\$0	\$0	\$0	\$0	0.06	\$0	\$0
2058	\$0	\$0	\$0	\$0	0.06	\$0	\$0
2059	\$0	\$0	\$0	\$0	0.05	\$0	\$0
2060	\$0	\$0	\$0	\$0	0.05	\$0	\$0
Total Present Value of Discounted Benefits over Project Life (Monetized Benefits):					\$18,284,858		
Total Present Value of Discounted Benefits (Monetized Benefits):					Project Allocation:		
					100%		
					\$18,284,858		

Table 8.A.4.4 - Annual Other Water Supply Benefits (2009 Dollars)						
Project: Santa Anita Stormwater Flood Management and Seismic Strengthening Project						
(a) Year	(b) Type of Benefit		(c) Description of Benefit:		Discounting Calculations for Economic Benefit	
	(b) Type of Benefit	(c) Description of Benefit:	(d) Annual Benefit (\$)	(e) Annual Benefit (\$)	(f) Discount Value	(g) Discounted Benefit (h x i)
	(d) Annual Benefit (\$)	(e) Annual Benefit (\$)	(d) Annual Benefit (\$)	(e) Annual Benefit (\$)	(f) Discount Value	(g) Discounted Benefit (h x i)
2009					1	\$0
2010					0.943	\$0
2011					0.89	\$0
2012					0.84	\$0
2013					0.79	\$0
2014					0.75	\$0
2015					0.71	\$0
2016					0.67	\$0
2017					0.63	\$0
2018					0.59	\$0
2019					0.56	\$0
2020					0.53	\$0
2021					0.5	\$0
2022					0.47	\$0
2023					0.44	\$0
2024					0.42	\$0
2025					0.39	\$0
2026					0.37	\$0
2027					0.35	\$0
2028					0.33	\$0
2029					0.29	\$0
2030					0.31	\$0
2031					0.28	\$0
2032					0.26	\$0
2033					0.25	\$0
2034					0.23	\$0
2035					0.22	\$0
2036					0.21	\$0
2037					0.2	\$0
2038					0.19	\$0
2039					0.17	\$0
2040					0.16	\$0
2041					0.16	\$0
2042					0.15	\$0
2043					0.14	\$0
2044					0.13	\$0
2045					0.12	\$0
2046					0.12	\$0
2047					0.11	\$0
2048					0.1	\$0
2049					0.1	\$0
2050					0.09	\$0
2051					0.09	\$0
2052					0.08	\$0
2053					0.08	\$0
2054					0.07	\$0
2055					0.07	\$0
2056					0.07	\$0
2057					0.06	\$0
2058					0.06	\$0
2059					0.05	\$0
2060					0.05	\$0
Total Present Value of Discounted Benefits over Project Life (Monetized Benefits):			Total Present Value of Discounted Benefits (Monetized Benefits):		100%	
					\$0	

Table 8.A.5 - Total Water Supply Benefits (2009 Dollars)				
Project: Santa Anita Stormwater Flood Management and Seismic Strengthening Project				
(a) Total Discounted Water Supply Benefits	(b) Total Discounted Avoided Project Costs	(c) Other Discounted Water Supply Benefits	(d) Total Value of Discounted Benefits (a + c) or (b+c)	
\$4,883,554	\$18,284,858	\$0	\$23,168,411	

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project**

APPENDIX 8-B

MWD Project Tables

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Appendix 8-B:

Estimating the Future Avoided Import Water Supply Costs of Developing Local Supplies in the Greater Los Angeles County Region

Introduction

Increased water produced locally within the Metropolitan Water District of Southern California (MWD) service area through conservation, recycling, groundwater recharge, groundwater extraction, and other sources will reduce the demand for imported water by the Los Angeles Region. MWD member agencies will substitute locally produced water supplies for imported water from MWD, assuming the locally produced water is less expensive than imported water. The value of adding new local supplies to satisfy local demand in place of imported water can thus be estimated based on the avoided cost of purchasing imported water.

The cost savings arising from reducing demands for imported water should be estimated based on the projected future cost of imports, at the margin. This in turn requires a projection of the cost of providing additional imported water at the levels needed in the future if local resources are not expanded in accordance with the Greater Los Angeles County Region IRWM Proposals. The key empirical question for valuation is thus, “What is the future cost, at the margin, of acquiring another acre-foot (AF) of imported water, and having it delivered (and treated, where applicable) to the users of the local supply alternatives?”¹

There are several empirical and conceptual challenges to forecasting the future avoided cost of import water. This Appendix discusses these issues and how they were addressed to develop the avoided water supply costs that are used to evaluate the benefits of this project that provides local water (or conserve water) in the Los Angeles region.

MWD Wholesale Water Supplies and Current Prices

Water Supply

The Metropolitan Water District of Southern California (MWD) is the major municipal and industrial water wholesaler in the Southern California region. With 26 member agencies serving approximately 19 million people 6,023 acre feet of water each day, MWD projects it will sell 1.75 million AF during 2010-2011.²

MWD sources water from a combination of local and imported sources. Imported sources included water diverted from the Colorado River via the Colorado River Aqueduct, from the San Francisco Bay Delta region via the State Water Project (SWP) and from the Owens Valley /

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Mono Basin via the Los Angeles Aqueduct (LAA). Imported water accounted for approximately 55 percent of the MWD's water supply between 2006 and 2008, of which approximately 93 percent was sourced from the Colorado River Aqueduct (50 Percent) and SWP (43 percent).³ Local sources, which included recycled water, surface water and ground water, fed largely by the San Gabriel, Santa Ana, and Los Angeles River systems, accounted for the remaining 45 percent of the MWD's water supply between 2006 and 2008. Groundwater sources make up the vast majority, or approximately 90 percent, of natural local water supplies. Recycled water and recovered groundwater are the MWD's fastest growing new sources of local water; between 2005 and 2009, the use of recycled water nearly doubled, and groundwater recovery increased from approximately 708 thousand AFY to nearly 100 thousand AFY.

Current Water Rates

MWD sells both untreated and treated water to its member agencies. As the name suggests, untreated water is raw and has not been processed to meet minimum standards acceptable for human consumption.⁴ Treated water has been treated and meets federal drinking water standards.⁵ Treated water is more expensive than untreated water because of the additional inputs required for its production. The current treated water surcharge for MWD (effective January 1, 2011) is \$217 AF. Treatment costs have increased to that level from \$82 per AF in calendar year 2003.⁶

MWD has established a two-tier rate structure intended to provide both assurances of needed supplies and encouragement for the local development of water resources by member agencies. Tier 1 water rates reflect the cost MWD incurs to maintain a consistent and reliable water supply for its customers. Tier 2 water rates, reflect the costs MWD incurs to develop additional water supplies to meet customer demand, which are set higher than Tier 1 rates in order to encourage efficient use of local supplies. MWD also utilized discounted rate for surplus water supplies from within the MWD system than can be used for replenishing local supply sources.

Both treated and untreated full service Tiered volumetric water rates are function of volumetric charges (\$ per AF) relating to maintaining, pumping, and delivering water to member agencies. For Tier 1 MWD water, these price components are \$101, \$154, and \$119 per AF respectively effective January 1, 2011. Additional volumetric charges for full service Tier 1 MWD water included a Delta surcharge (\$69 per AF) reflecting pumping restriction on the State Water Project, and a stewardship charge (\$41 per AF) reflecting maintenance and development of local water supplies. These price components total \$484 per AF as the full service volumetric charge for untreated Tier 1 MWD water effective January 1, 2011. After adding the treatment surcharge of \$217, the full service volumetric charge for treated Tier 1

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MWD water is \$701 per AF. Untreated and treated replenishment water rates are computed as discounts off the tiered water rates.

In addition to the variable charges, described above MWD water rates included fixed charges. Fixed charges are those which are primarily invariant with water volume and include, across all MWD water sources, system capacity and readiness-to-serve charges. Readiness-to-Serve (RTS) charges are fixed charges associated with the portion of the MWD supply system maintained on as needed basis, while the Capacity charge recovers the cost of delivering water within the MWD system at peak usage periods. Effective January 1, 2011, the MWD RTS charge will total \$114 million while the Capacity charge will total approximately \$10 per AF.⁷

Projected Future Water Rates

Many factors affecting supply and demand for MWD water have caused wide differences between projected and actual water rates over the last several years. Court decisions beginning in 2007 severely impacted Sacramento-San Joaquin Delta exports and reduced dramatically the availability of SWP water to MWD. Concurrently, court decisions and several years of drought have reduced the availability of Colorado River Water, historically also a major source of MWD water. These factors have affected the available supply of MWD at all price levels. Additional factors, affecting the supply side include changes in the cost of productive inputs such as labor, power, and chemicals for water treatment. Factors affecting the demand for MWD water include conservation efforts, efficient technologies, and the availability of substitute water supply sources, among others.

Drought, legal rulings, and basic supply and demand will continue to have important, but at present unknown, impacts on water availability and prices in the future, making both short-term and long-term projections subject to errors characteristic of the forecasting process.

Table 8-B-1 compares Tier 1 water rate projections published by MWD for 2005-2009 with actual water rates to illustrate differences in forecasted and actual water rates. As table 8-B-2 shows, the margin of error associated with the forecast increases with period of time for which rates are forecast. This analysis requires MWD water rates be forecast through 2060 to match the length of time over which benefits of reduced demand for imported water accrue.

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Table 8-B-1: Comparison of Projected and Actual MWD Tier 1 Water Rates

Year	Projected		Actual		Difference (a)	
	Untreated	Treated	Untreated	Treated	Untreated	Treated
2005	\$331	\$443	\$331	\$443	0.0%	0.0%
2006	\$335	\$460	\$331	\$453	-1.2%	-1.5%
2007	\$345	\$476	\$331	\$478	-3.9%	40.0%
2008	\$361	\$497	\$351	\$508	-2.6%	2.3%
2009	\$379	\$523	\$436	\$620	15.0%	18.7%
Notes: All dollar values are nominal. Projected Tier 1 MWD water rates are sources from the 2004/05 Long Range Finance Plan, whereas actual MWD Tier 1 water rates are sources from the MWD "Water Rates and Charges". Projected MWD Tier 1 water rates are computed as the midpoint of the low and high projected rates.						

The appropriate unit price for valuing avoided costs of imported water purchase depends upon the type of local supply developed, and in turn, the type of water that would have been used in its place under the no project alternative. It was assumed that increases in water produced locally within the Los Angeles region through conservation, desalination, surface water improvement, water reclamation, and groundwater recharge will replace purchases of MWD water at the full service Tier 1 rate. Application of the treated and untreated full service Tier 1 rates depends on the specifics of each local water supply project.⁸

MWD full service treated and untreated Tier 1 and untreated replenishment water rates are projected beginning with calendar year 2011. Actual MWD full service Tier 1 and replenishment water rates effective January 1, 2009, September 1, 2009 and January 1, 2010 are used for 2009-2010.⁹ Water rates published by WD are effective January 1, 2011 and January 1, 2012 are used for 2011-2012. Rates projected for 2013-2060 are based on projected year-over-year percentage changes in MWD water rates as reported at the July 2010 MWD Member Agency Manager Meeting on the Long Range Finance Plan. A 6% year-over-year percentage change is used to forecast MWD rates for 2013-2020, while a 3% annual change is used to forecast MWD rates for 2021-2060.¹⁰ These annual percentage changes are nominal percentage changes, because they include the effect of inflation on water rates, and projected MWD full service Tier 1 and untreated replenishment water rates are nominal as a result.

The resulting nominal MWD water rates projected for each year 2009-2060 are deflated to real 2009 dollar values using the Consumer Price Index (all items) for All Urban Consumers (CPI-U) in the Los Angeles – Riverside County – Orange County Metropolitan Statistical Area, for which the actual value was used for 2009 and projected values were used for 2010-2060.¹¹ Annual nominal water rates were deflated to 2009 dollars values by the following formula:

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$$\text{Real Water Rate}_t = \text{Nominal Water Rate}_t / (\text{CPI-U}_t / \text{CPI-U}_{2009})$$

Table 8-B-2 reports the projected real MWD full service Tier 1 and untreated replenishment water rates used to measure the avoided cost of imported water purchase in this analysis. Annual year-over-year percentage changes in the real water rates are also reported in the final three columns of Table 8-B-2.

Table 8-B-2:

Year	Projected Real MWD Water Rates (\$/AF)*		% change in Projected Real MWD Water Rates	
	Tier 1		Tier 1	
	Treated	Untreated	Treated	Untreated
2009	620	436		
2010	690	476	11.29%	9.17%
2011	726	513	5.22%	7.77%
2012	760	537	4.68%	4.68%
2013	793	560	4.34%	4.28%
2014	826	583	4.16%	4.11%
2015	856	604	3.63%	3.60%
2016	887	626	3.62%	3.64%
2017	919	649	3.61%	3.67%
2018	952	672	3.59%	3.54%
2019	987	697	3.68%	3.72%
2020	1023	722	3.65%	3.59%
2021	1032	729	0.88%	0.97%
2022	1043	736	1.07%	0.96%
2023	1053	743	0.96%	0.95%
2024	1063	751	0.95%	1.08%
2025	1073	758	0.94%	0.93%
2026	1084	765	1.03%	0.92%
2027	1095	773	1.01%	1.05%
2028	1105	780	0.91%	0.91%
2029	1116	788	1.00%	1.03%
2030	1127	796	0.99%	1.02%
2031	1138	804	0.98%	1.01%
2032	1149	811	0.97%	0.87%
2033	1161	820	1.04%	1.11%
2034	1172	828	0.95%	0.98%

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2035	1184	836	1.02%	0.97%
2036	1195	844	0.93%	0.96%
2037	1207	852	1.00%	0.95%
2038	1219	860	0.99%	0.94%
2039	1231	869	0.98%	1.05%
2040	1243	878	0.97%	1.04%
2041	1255	886	0.97%	0.91%
2042	1267	894	0.96%	0.90%
2043	1280	903	1.03%	1.01%
2044	1292	912	0.94%	1.00%
2045	1305	921	1.01%	0.99%
2046	1318	930	1.00%	0.98%
2047	1330	939	0.91%	9.70%
2048	1344	949	1.05%	1.06%
2049	1357	958	0.97%	0.95%
2050	1370	967	0.96%	0.94%
2051	1383	977	0.95%	1.03%
2052	1397	986	1.01%	0.92%
2053	1411	996	1.00%	1.01%
2054	1424	1006	0.92%	1.00%
2055	1439	1016	1.05%	0.99%
2056	1452	1025	0.90%	0.89%
2057	1467	1036	1.03%	1.07%
2058	1481	1046	0.95%	0.97%
2059	1496	1056	1.01%	0.96%
2060	1510	1066	0.94%	0.95%

*All prices are reported in constant 2009 dollars

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project**

APPENDIX 8-C

Santa Anita Stormwater Flood Management and Seismic Strengthening Project Water Conservation Model

Water Supply Model

Using actual storm data for 1996 - 2010

Excel Spreadsheet contains actual data

Runs for:

Without Project –

- Santa Anita Dam Sluice gate is open
- Headworks washes out at 300 cfs until flows recede to 10 cfs (when District forces can repair)
- Headworks diversion to Spreading Grounds (Santa Anita and Sierra Madre) is closed when flows are greater than 75 cfs until it reduces to 50 cfs, and as long as levee is still intact.
- Santa Anita Debris Basin sluice gate is open

With Project –

- Riser in place
- Headworks handles diversion to 1000 cfs
- Santa Anita Debris Basin can store water for conservation
- Santa Anita Spreading Grounds has increase capacity and diversion ability

Water Year: 1996-2010
Baseline with Dam Cleanout

Santa Anita Dam

Uncontrolled Outflow:	77,050	ac-ft
Total S.A. Dam Outflow:	<u>77,050</u>	ac-ft

Santa Anita SG

Santa Anita SG Inflow:	21,682	ac-ft
Santa Anita SG Overflow:	3,841	ac-ft
Santa Anita SG Infiltration Total:	<u>17,841</u>	ac-ft

Sierra Madre SG

Sierra Madre SG Inflow:	25,660	ac-ft
Sierra Madre SG Overflow:	86	ac-ft
Sierra Madre SG Infiltration Total:	<u>25,574</u>	ac-ft

Total SG Infiltration

Santa Anita + Sierra Madre:	43,415	ac-ft
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Total Losses

Santa Anita SG Overflow:	3,841	ac-ft
Sierra Madre SG Overflow:	86	ac-ft
Santa Anita Channel Flow From D.B.:	<u>29,707</u>	ac-ft
	33,634	ac-ft

Correlation

Total Inflow:	77,059	ac-ft
Starting Volume:	-	ac-ft
Ending Volume:	<u>9</u>	ac-ft
Balance:	77,050	ac-ft
Total Outflow:	77,050	ac-ft
Difference:	OK	

Water Year: 1996-2010

Proposed Dam Rehab

Santa Anita Dam

Uncontrolled Outflow:	76,862 ac-ft
Total S.A. Dam Outflow:	<u>76,862 ac-ft</u>

Santa Anita SG

Santa Anita SG Inflow:	27,495 ac-ft
Santa Anita SG Overflow:	5,641 ac-ft
Santa Anita SG Infiltration Total:	<u>21,854 ac-ft</u>

Sierra Madre SG

Sierra Madre SG Inflow:	29,026 ac-ft
Sierra Madre SG Overflow:	211 ac-ft
Sierra Madre SG Infiltration Total:	<u>28,815 ac-ft</u>

Total SG Infiltration

Santa Anita + Sierra Madre:	50,669 ac-ft
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Total Losses

Santa Anita SG Overflow:	5,641 ac-ft
Sierra Madre SG Overflow:	211 ac-ft
Santa Anita Channel Flow From D.B.:	20,340 ac-ft
	<u>26,192 ac-ft</u>

Correlation

Total Inflow:	77,059 ac-ft
Starting Volume:	- ac-ft
Ending Volume:	<u>197 ac-ft</u>
Balance:	76,862 ac-ft
Total Outflow:	76,862 ac-ft
Difference:	OK

